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MUSCI ARCHIPELAGI INDICI.

(PREPARED AND DISTRIBUTED BY MAX FLEISCHER.)

The seventh series of these very interesting mosses have been recently received, including numbers 300-350. They are accompanied by a printed index and each label bears the date of issue as well as of collection! They include mosses from Java, West Java and Ceylon, with a few from Borneo, Malacca and Singapore. The specimens are abundant and well prepared, the labels models of typography. Of one rare species, *Ephemeropsis Tjibodensis*, large leaves, covered with this species have been distributed. Many of the genera are familiar, but the species are almost all different. There are some new species and many new combinations in these exsiccatae.

New York Botanical Garden.

E. G. BRITTON.

A CORRECTION.

Hypnum eugyrium var. *viridimontanum*, published in the May BRYOLOGIST, appears to be *Raphidostegium Marylandicum* (C. M.) J. & S. This was discovered some time before THE BRYOLOGIST was printed, but through a misunderstanding was not corrected.

A. J. G.

LICHENOLOGY FOR BEGINNERS--II.

FREDERICK LEROY SARGENT.

(Begun in May 1906, issue.)

Among the first specimens a student is likely to collect there will almost surely be found examples of the species known as *Parmelia conspersa*, which grows most plentifully on stone walls and rocks in pasture land. Its general form is shown in Fig 1. The upper surface is pale greenish or straw color, becoming darkened with age; the under surface is dark

brown or black. Upon the upper side there are almost always to be found a number of chestnut-colored saucer-shaped fruits. This *Parmelia* will answer as a typical example from which we may gain a good idea of the essential parts of a lichen and their general structure, after which we may more profitably consider the various modifications of these parts which appear in other members of the group.

A cursory examination of our plant shows it to be a mat-like, much-lobed expansion, upon which are borne the conspicuous fruits. The latter are called *apothecia* (AP., Fig. 2); the main part of the

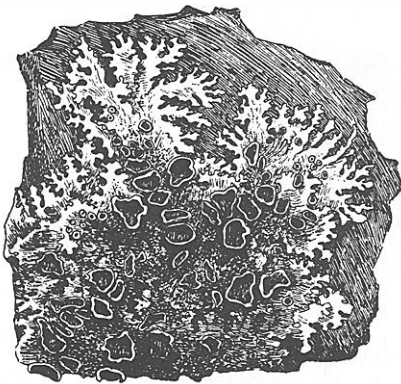


Fig. 1.
Parmelia conspersa. Natural size.
(After Rabenhorst.)

plant-body is termed the *thallus* (Th., Fig. 2). The thallus increases in size by elongation and repeated branching of the lobes near their tips: hence the older portions are towards the center. From the under side of the thallus are developed numerous projections, called *rhizoids* (Rz., Fig. 2), which serve to attach the plant to the "substrate," or surface upon which it rests. Occasionally, upon the upper surface of the thallus appear little granular or powdery heaps (Sd., Fig. 2), called *soredia*. These are sometimes so numerous as to alter considerably the appearance of the lichen. Finally, close scrutiny with the magnifier will bring to view a number of black specks scattered irregularly over the lobes. Each is the mouth of a small cavity, called a *spermagone*, which extends into the body of the thallus (Sg., Fig. 2).

If a very thin slice cut across the thallus be examined with a magnifying power of two or three hundred diameters, the structures shown in Fig. 3 are



Fig. 2.

The same. Diagrammatic vertical section. Th., thallus; Rz., rhizoids; Sd., soredia; Ap., apothecium; Sg., spermagone. (Original.)

exhibited. The principal mass is composed of delicate tubular threads, called *hyphæ* (H), which are rather loosely interwoven to form an inner or *medullary layer* (M), and firmly compacted toward the surface of the thallus, forming a *cortex* (C) above and below. Just below the upper cor-

tex is an irregular layer composed of innumerable bright green bodies (G) interspersed among the medullary hyphæ. These little bodies are termed *gonidia*. In each we may distinguish a transparent envelope surrounding the green protoplasmic contents. Close examination will show that branches of the medullary filaments are often in intimate contact with the gonidia.

For many years after their discovery it was believed that this close connection indicated that the gonidia were outgrowths from the hyphæ or *vice versa*. In 1869, however, the great German botanist Schwendener showed there were strong reasons for believing that the gonidia are not genetically connected with the hyphæ, but are minute *Algae*, upon and around which had grown the hyphæ of a parasitic fungus; in other words, that a lichen is not a single individual possessing as organs hyphæ and gonidia, but is a community consisting of (1) a host of small *Algae*—such as one finds growing by themselves on trees and rocks—and (2) a fungus, the like of which is also found living separately upon bark, but which in a lichen has become adapted to imprison *Algae* and gain nutriment from them.

Ever since Schwendener's time important evidence has been accumulating to confirm his view, until to-day it appears to be as well proved as Harvey's theory of the circulation of the blood. Without going at length into the details of this evidence, we may cite, in brief, the following facts:

1. All known forms of gonidia have been found to resemble species of *Algae* (belonging to several diverse families) which grow in situation

favorable to their being attacked by lichen-fungi. The only differences between the gonidia and the free *Algae* are such as would naturally follow from their different conditions of life.

2. What the theory considers to be the fungal part of lichens agrees in most important particulars with certain non-lichenous fungi, belonging to three different orders; and while the fungal part of some lichens differs considerably from the other fungi of their order, there are all gradations between these species, and some which cannot be distinguished from non-lichenous forms, except by their growing in contact with gonidia.

3. Gonidia have been separated from lichens and made to grow by themselves, when they exhibit all the characteristics of free *Algae*.

4. Lichen-fungi have been made to grow without gonidia, like other fungi, by supplying them with organic food in solution.

5. Lichen-fungi have been made to grow upon free *Algae*, and upon gonidia taken from other species of lichen, and produced a regular lichen-thallus.

6. The hyphal part of certain lichens is for some time entirely without gonidia, and gains its nutriment from bark, like other fungi; later it feeds on *Algae*.

Regarding the function of gonidia, there is but one opinion, namely, that they are the food producers of the little community, and give of their abundance to the hyphæ, which latter in the absence of some

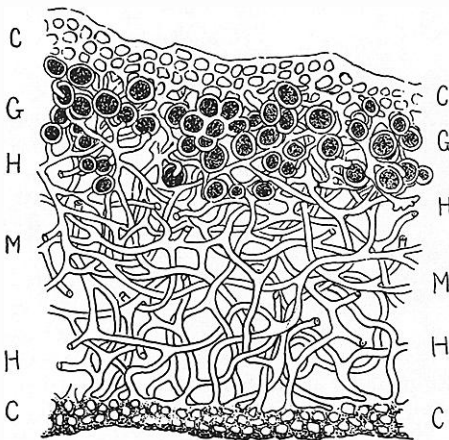


Fig. 3.

The same. Vertical section of thallus, magnified about 250 diameters. H. hyphæ; M., medulla; C. cortex; G., gonidia. (Original)

such supply of organic material could not live. We may compare the lichen-fungus to a farmer, and the gonidia to his cattle which yield him food, while he in turn shelters them and otherwise provides for their necessities.

There can be no doubt that the gonidia thrive under the conditions imposed upon them, for they multiply so rapidly as to burst through the cortex, thus giving rise to the soredia before mentioned. Each soredium is, in fact, a tiny cluster of gonidia surrounded by hyphæ. When detached and carried by the wind to some moist surface favorably situated, it grows into a lichen the same as that from which it was derived. Soredia are thus little colonies sent out by a parent community. With certain species, especially in certain localities, this is the chief—if not the only—method of reproduction. It will readily be seen how admirably adapted is this method for

securing wide distribution of sorediiferous lichens. Even when no *Algae* are present, as on freshly exposed rock surfaces, soredia may establish themselves.

The apothecia, or proper fruit of our typical lichen, consists essentially (see Fig. 4) of (1) a number of short hyphal branches perpendicular to the

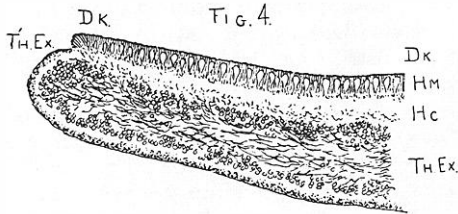


Fig. 4.

The same. Vertical section of apothecium, magnified about 50 diametres. TH., Ex., thalline exciple; Hc., hypothecium; Hm., hymenium; Dk. disk

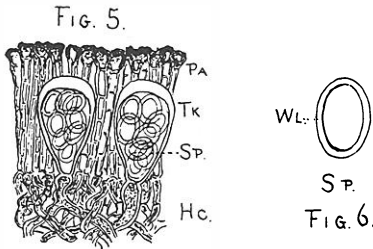
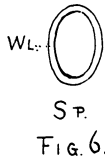


Fig. 5.

The same. A portion of the hymenium, magnified about 350 diametres. PA., paraphyses; Tk., theka; Sp., spore; Hc., hypothecium.

Fig. 6.

The same. A spore, magnified about 1,000 diametres. WL., wall. (Original.)



surface, and compacted into a dense layer, called the *hymenium* (Hm.), which arises from (2) a denser tangle of hyphæ, termed the *hypothecium* (Hc.). The surface of the hymenium is called the *disk* (Dk.). These parts (in *Parmelia*) are more or less enveloped by a continuation of the thallus (compare Fig. 2), called the *thalline exciple* (Th. Ex.).

The hyphal branches which compose the hymenium are of two sorts: (1) slender filaments (*paraphyses*, Pa., Fig. 5), each ending at the surface in a colored knob, and (2) club-shaped sacs (*thekes* or *thecæ*, Tk.) each of which contains when mature usually eight minute bodies known as *spores* (Sp.) The spores are reproductive bodies, each capable under suitable conditions of growing into a lichen-fungus like the parent. In our *Parmelia* the spores (Fig. 6) are simple cells, ellipsoid in form, and consist of a delicate transparent wall (WL.), enclosing gelatinous (protoplasmic) contents which are colorless or but faintly tinged. The paraphyses besides affording some protection to the young thekas during development, aid in the ejection of the spores. Under the influence of moisture the paraphyses swell, and thus press upon the ripe thekas so that the apices are ruptured and the spores squeezed out with considerable force. A melon seed pressed between thumb and finger illustrates well what happens.

Cambridge, Mass.

(To be Continued.)